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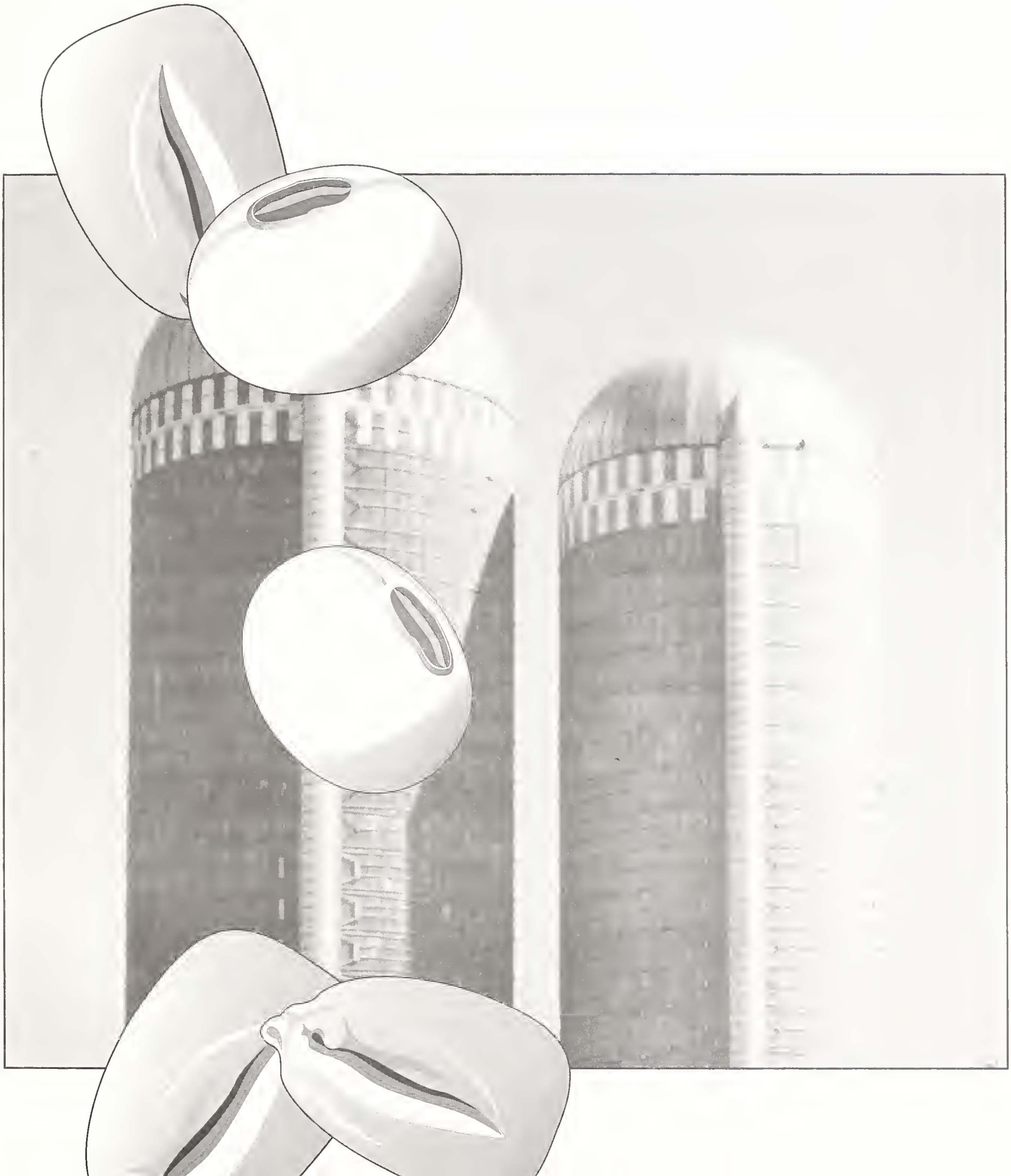
Co-op Involvement and Opportunities in the Seed Industry



Abstract

Cooperative Involvement and Opportunities in the Seed Industry

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This study examines both the strengths and weaknesses of cooperative involvement in the seed industry. Although the focus is on cooperatives, investor- owned firms and public research institutions are also discussed. The three major areas studied in this report are research, production, and marketing. The 14 interviews conducted included 9 regional cooperatives, 3 investor-owned firms, and 2 agricultural experiment stations. The rapidly changing seed industry provides the cooperative system with a unique opportunity to assist the American farmer.

Keywords: Seed, cooperative, research, production, marketing, and sales.

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Preface

This study describes the trends and characteristics of the seed industry. The three major areas discussed are research, production, and marketing. The focus is on regional cooperatives, multinational seed companies, and public institutions. This study should be useful to cooperative leaders and seed industry experts.

This report is based on extensive literature review and on interviews with several prominent figures in the seed industry. A total of 14 interviews were conducted, which included individuals from 9 regional cooperatives, 3 investor-owned firms, and 2 public agricultural experiment stations.

The authors wish to acknowledge the efforts of the individuals who provided their time and information to make this report possible. Special thanks are given to Dr. R. Bruce Hunter, who reviewed and commented on an earlier draft of this report, and to Ed Meeks, who provided helpful editorial comments.

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Highlights

If American farmers are to continue to have an influence on the seed industry, cooperatives need to maintain some presence in seed research and development. Maintaining this presence in a capital-intensive industry where publicly funded research is diminishing will be increasingly difficult. The availability of new seed varieties to cooperatives unable to fund their own seed research programs will continue to decline.

One area of concern for researchers at cooperatives, investor-owned firms, and public research institutions is plant protection. Since 1985, utility patents have been used increasingly to protect the property rights of the research firm. This has caused some controversy because it tends to restrict the transfer of information and germplasm throughout the industry. Most plant breeders would prefer to use Plant Variety Protection Certificates (PVPC). But the farmer's exemption, which allows farmers to produce their own seed and sell the excess without paying royalties or other fees, is a major problem This is because some farmers appear to abuse the exemption by producing seed almost exclusively for sale. As a result, it is difficult for the researcher to recover research and development costs.

Another area of controversy is the role of public research in the seed industry. Some feel that universities should concentrate on basic research and leave applied research to the private sector. On the other hand, many believe that universities will not be able to turn out knowledgeable plant scientists if they are not involved in the whole process of varietal development. Increasingly, universities are relying on the private sector for funding and are restricting the use of public domain plant varieties through marketing agreements.

Other factors that influence research are changing environmental regulations and the development of niche markets. Environmental issues may have a major impact on agriculture in the near future. Consumer concerns over pesticide and chemical residues may provide support to the "green movement" and further challenge the use of agricultural chemicals. Restrictions placed on the use of agricultural chemicals will advance the study and use of plants that carry natural or genetically altered pest and disease resistance.

The field of biotechnology is making tremendous strides and may soon be able to incorporate many resistant characteristics into the genetic makeup of agricultural crops. Through biotechnology, researchers will also be able to develop "designer" seeds. These seeds will be developed to meet specific industrial requirements or the needs of specific "niche" markets. Niche markets are already beginning to influence research by shifting the emphasis away from increasing output toward more efficient production and processing.

These advances in research will require closer ties between the researcher, the producer/farmer, and the processor. The end user will need to share some of the risks or costs associated with this research, including paying a premium for the commodity possessing the industry-specific trait. Cooperatives provide a natural link between farmers and processors and should be able to provide some bargaining leverage for their member producers.

Farmers are demanding more services, due in part to the increase in the price of agricultural inputs. Seed prices, on average, have increased by more than 25 percent in the past 5 years. Cooperatives and farm supply stores appear to be in a better position to provide services to the farmer than do farmer/dealers and direct distributors. Many cooperatives employ agronomists and field specialists for the benefit of their owner/patrons. Some cooperatives and farm supply stores are experimenting with employing seed specialists. One problem with employing a seed specialist is that the margins on most seed sales do not justify the expense of retaining the seed specialist.

The way seeds are marketed depends on the type of seed and region where they are sold. Farmer/dealers tend to dominate the market in areas where farms are large and where relatively few types of crops are grown. But where farms are smaller and relatively highly diversified, cooperatives and investor-owned farm supply stores provide the main avenue for seed distribution.

Regardless of the region being served, advertising is important. One of the more effective forms of advertising involves the use of local test plots and field trials where farmers can compare the performance of different brands of seed under local growing conditions.

Slow growth in domestic seed sales is pushing seed companies to look for new markets, and seed companies are discovering that the export market provides an excellent source of revenue. Export seed must be developed for the specific climate, growing conditions, and societal views of the export area. The outlook and objectives of the foreign farmer may be different from the American farmer's. Due to the traditional cooperative owner/user philosophy, cooperatives are failing to take advantage of the available export opportunities. Cooperatives, even large regional cooperatives, tend to have a domestic market outlook.

A cooperative can use several different strategies in the seed industry. At one extreme, a cooperative can be a distributor or marketer of another firm's seed. At the other extreme, a cooperative's activities may include conducting research and distributing its own brand of seed. Although opportunities exist for cooperatives at the extremes, they also exist through some combination of these two strategies. Cooperatives must determine which combination best meets their members' needs.

Seed research, especially through biotechnology, is too costly for many cooperatives to develop individually. Yet, if cooperatives wish to remain active in the seed industry, they must participate in biotechnology. A cooperative can procure seed and biotechnology research through a variety of methods. It can (1) form a seed research and biotechnology cooperative or firm; (2) form a full or limited joint venture with a seed biotechnology firm; and/or (3) maintain its present position and develop marketing agreements with seed biotechnology firms.

Cooperative Involvement and Opportunities in the Seed Industry

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OVERVIEW

One of the original purposes of farm supply cooperatives was to provide farmers with an improved, more consistent seed supply. In the early years, cooperatives acted as seed distributors relying on State and Federal experiment stations and private seed companies to conduct plant breeding research. As the industry moved toward proprietary branded seeds, larger cooperatives began their own research and breeding programs. However, in recent years, fewer cooperatives have been producing their own seeds, and their role in the seed industry has been declining.

Today, even though there are more than 2,500 cooperative farm supply stores in the United States, with aggregate seed sales in excess of $500 million, they represent only around 15 percent of the agricultural seed market. If the American farmer is to continue having an influence on the seed industry, cooperatives need to maintain a presence in seed research and development. Maintaining a presence in an industry where publicly funded research is diminishing will be increasingly difficult. The availability of new seed varieties to cooperatives unable to fund their own seed research programs is declining.

To gain insight into the overall operations of the seed industry, interviews were conducted with nine regional cooperatives, three investor-owned firms, and two agricultural research stations. The firms selected provided a diverse range of opinions on the future of the seed industry. Information obtained from these interviews is included in the following sections in which industry influences and trends, research, production, and marketing in the seed industry are discussed.

INDUSTRY INFLUENCES AND TRENDS

In today's emerging global economy, U.S. farmers must compete in the world market against both the cheap land and labor of less developed countries and the sophisticated technologies of the advanced industrialized nations. Since the early 1900's, U.S. farmers have relied on larger machines and the increased use of agricultural chemicals to maximize output. Less thought has been given to efficiency in production. If today's farmers are to succeed, they must aggressively adopt the new technologies of "precision agriculture" to reduce the real costs of production. Many of these new technologies will be incorporated into the genetic makeup of the seed itself.

Seed Sales

In 1989, total seed sales for farm production increased to $3.73 billion from $3.27 billion in 1988. Over this same period, cooperative seed sales dropped from $577 million to $573 million. Cooperatives lost more than 2 percent of their market share. In 1989, cooperative sales represented 15.4 percent of all seed sold for agricultural production, down from 17.7 percent in 1987 (table 1). There were 2,635 cooperatives handling seed in 1989, down dramatically from 3,607 in 1981.

Today seed sales account for less than 3.5 percent of the cooperative system's farm supply sales and only 2.5 percent of the farmer's total production costs. Within the next decade, this expense is expected to increase dramatically due to the rising cost of seed research and development. If farmers want to keep these costs down, their cooperatives will need to become more involved in all aspects of the seed industry.

Table 1—Seed sales for farm production and cooperative market share

Year	Total seed sales[1]	Change	Cooperative sales	Change	Cooperative market share
	Dollars	*Percent*	*Dollars*	*Percent*	*Percent*
1981	3,428		575	16.77	
1983	2,690	-27.43	483	-15.95	17.95
1985	3,128	14.00	510	5.63	16.36
1987	3,259	0.04	577	12.97	17.70
1989	3,733	12.69	573	-0.61	15.35

[1]Sales are in $1,000,000.
Source: Agricultural Statistics, 1990 and Farmer Cooperative Statistics, 1981-1989, U.S. Department of Agriculture.

End Users

For years, agricultural seed research has focused on increasing production. It was believed that increased output would be in the best interest of farmers and, ultimately, the Nation as a whole. Individuals interviewed for this study felt that agricultural seed research has recently become more market or trait oriented and less production driven. Tight competition is moving the industry toward a more focused, customer-oriented environment with niche markets playing a key role. When planning their agendas, researchers now must consider the preferences of two distinct groups: farmers and processors, or other end users.

Farmers are pushing for less expensive production techniques, either through lowered input costs or through a more efficient farming system, or both. Increased output will not benefit the farmer if production costs increase more than the value of the increased output. Research investment and long-term commitment must focus on developing and servicing products that provide added value to the farmer. Technologies such as seed coatings or genetically engineered seed that is disease or pest resistant hold the potential of offering great savings to the American farmer.

Niche markets are developing into an important sector within the seed industry. Processors and other end users must be willing to fund, at least in part, the higher cost of research and marketing incurred in production, transportation, and storage of these niche commodities. Vertical marketing agreements most likely will be required to ensure a viable market for a new product. For instance, the tofu industry has financed research resulting in the development of a clear hilum soybean designed to meet processing needs. This clear hilum soybean is ill suited for the general soybean market. To induce production of this relatively high risk product, the tofu industry has been willing to contract with farmers for production. In this case, the end user has been willing to enter into marketing agreements and to help pay for research and production costs.

Environment

Current and impending environmental legislation will influence agriculture and the direction of future agricultural research. One current response to environmental concerns is integrated pest management (IPM). IPM attempts to decrease the use of agricultural chemicals by using crop rotations, pest-resistant varieties, and other biological practices. Farmers wishing to adhere to IPM techniques may soon be using biopesticides that are incorporated into the seed germ-plasm. They will not need to use as many agricultural chemicals because the plant will already have the resistance or tolerance built into its genetic makeup. Seed varieties will be genetically engineered to accomplish many of these new environmental management practices.

Mergers and Acquisitions

Large multinational petrochemical and pharmaceutical companies are entering the seed industry through mergers with, and/or buy-outs of, seed and biotechnology companies. One view in the seed industry is that hybridization and biotechnology will result in a concentrated seed industry where relatively few companies dominate plant breeding research.

Many recent acquisitions have allowed companies outside the seed industry to acquire plant breeding capabilities and marketing structures to enter the seed market. Developing market share by acquiring a business with a strong marketing position is often less costly and time consuming than to engage in a competitive battle to achieve market entry or through internal growth. Such strategic assets as proprietary technology, germ-plasm, brand image, distribution channels, trademarks, and managerial experience are difficult to develop internally. While conventional wisdom purports that the seed industry is undergoing consolidation, surveys conducted in 1982 and 1989 by the National Council of Commercial Plant Breeders (NCCPB) do not entirely support this premise (table 2). NCCPB sent out 203 surveys for these two studies. It is believed that the studies included 90 percent of the private-sector plant breeding programs and a large percentage of the plant biotechnology research programs.[1] The number of companies breeding canola, corn, forage grasses, soybeans, sugar beets, and turf grasses increased by 40 over the 7-year period. For grain sorghum, sunflowers, vegetables, wheat, and other small grains, the number of companies conducting breeding research declined by 35. The number of companies breeding alfalfa and other forage legumes, cotton, rice, safflower, and fruits remained relatively stable between 1982 and 1989.

With few exceptions, most seed associations have indicated that their membership numbers have not changed dramatically in the past few years. One possible explanation is that small seed companies, filling local niche markets, are replacing the mid-sized companies lost to mergers or acquisitions. It is interesting to note that both hybrid and open-pollinated varieties are present in each group listed above and in table 2.

Table 2—Number of companies conducting breeding programs on major crops in the United States

Major Crop Categories	No. of companies with breeding programs 1982	1989
Canola	0	6
Corn	66	75
Forage grasses	5	8
Peanuts	0	1
Soybeans	26	34
Sugar beets	5	10
Turf grasses	8	16
Total	110	150
Grain Sorghum	21	15
Oats, barley, rye, triticale	11	6
Sunflowers	16	9
Vegetable	44	37
Wheat	21	11
Total	113	78
Alfalfa-forage legumes	14	16
Cotton	13	11
Fruits	2	2
Rice	5	4
Safflowers	3	2
Total	37	35
Grand Total	260	263

Source: *Survey–Inputs in Private Sector Plant Breeding and Biotechnology Research Programs in the U.S.A.*, R.R. Kalton et.al., 1990, Unpublished.

[1]The 1989 survey included all members from the NCCPB, other companies who promote their research programs or researchers, seed companies known to be involved in biotechnology research, and non-seed companies involved with plant biotechnology research.

Property Rights

The Plant Patent Act, passed by Congress in 1930, provided protection for most plant varieties that reproduce asexually (e.g., through grafting or budding). Sexually reproduced plants (e.g., corn, soybeans, etc.) were excluded from the act, in part due to fear that seed breeders would gain a monopoly over staple crops. To acquire a plant patent (PP), a breeder must provide a description of the variety and prove it is distinct from other varieties. A description in botanical terms is sufficient. The Patent and Trademark Office issues a plant patent that lasts 17 years. During this time, only the patent holder may asexually reproduce or sell the plant. Plant patent protection extends only to the plant and not to the seed produced by the protected plant. Thus others may attempt to reproduce the plant through sexual reproduction.

Congress passed the Plant Varieties Protection Act (PVPA) in 1970 and amended it in 1980. The PVPA provides patent-like protection for a period of 18 years for most sexually reproduced varieties. To receive a plant variety protection certificate (PVPC), a breeder must show that the variety is distinct, uniform, and stable. Protection begins when the breeder applies to USDA for a certificate. The PVPA contains two exemptions: (1) Protected varieties must be made available for use by legitimate plant breeders in research programs; and (2) farmers whose primary occupation is crop production can sell their excess harvested seed. The second exemption can place a considerable drain on the seed industry. Industry estimates of sales losses due to the farmer's exemption range from as low as 2 percent to as high as 60 percent. In some instances, farmers have apparently increased production of protected varieties to increase their own seed sales.

The Supreme Court decided in the 1980 *Diamond v. Chakrabarty* case that micro-organisms were patentable. The *Ex parte Hibberd* case (1985) extended the Chakrabarty ruling to include plants, seeds, tissue cultures, hybrid plants, and hybrid seeds. These decisions resulted in the use of Utility Patents (UP) in the seed industry. A UP applies to both sexually and asexually reproducing plants and lasts for 17 years. The UP is more restrictive than either the PP or the PVPC. It does not contain a research or farmer exemption and can cover either multiple varieties or individual components of a single variety.

The UP has five distinct disadvantages when compared to a PP or a PVPC:

1. The patent applicant must provide full disclosure of the technology used to develop the variety, rather than a simple botanical description.
2. The holder must have the patented material stored in a depository. While depositories exist, most are set up for micro-organisms and few want to store seeds or whole plants.
3. The filing and issue fee for a UP is much greater than it is for a PP or a PVPC.
4. Protection begins only after the UP has been granted.
5. UP's must be written with research exclusions to allow the use of the patented material for further research.

It can take up to 30 years for investment in research and development to result in a marketable plant variety. Once a variety enters the market, its economic life may be as short as 2 years. Due to the relatively short economic life of many plant varieties, breeders need some type of varietal protection to ensure that many varieties become viable products. Since PP's are only available for asexually reproduced plants, PP protection is not an option for the majority of the industry. PVPC's provide for a research exemption facilitating germplasm exchange, but losses due to farmer seed sales serve to reduce the number of varieties that can be successfully marketed. Despite their drawbacks, UP's are the only option available that offers the protection needed for continued varietal research and development.

Industry experts interviewed for this report felt strongly that UP's were the only option under the current system that offered plant breeders the protection they needed. They also felt that in the long run, UP's would work to the detriment of the seed industry and, ultimately, the farmer. The industry experts felt that the lack of a built-in research exemption would result in a decrease in the availability of new germ-plasm. Although

PVPC's are the option preferred by plant breeders, their use will decrease unless some type of regulation is established to restrict the farmers' exemption and place limitations on the research exemption. This limitation would be in the form of a "minimum distance"[2] between protected varieties.

RESEARCH

If a seed research program is to succeed, the developed seed variety must be better than the seed that farmers can either purchase or produce themselves. This improvement can be expressed in term of higher germination rates, better yield and disease resistance, improved quality and marketability, characteristics allowing cost-saving cultivation methods, or a combination of these properties.

When compared with other industries involved in basic research, the seed industry does not require as much investment in capital equipment. A research facility, a small number of plant breeders, a processing plant, and a few research farms to produce seed are just about all that are needed. On the other hand, a large investment in time is needed to develop seed varieties; for example, a new hybrid seed corn could take 10 years or more to develop. Also, the seed enterprise needs money at harvest time to purchase the contracted grower's crop, process the seed, bag it, and inventory and distribute the seed for the coming season. Since unprocessed seed purchased at harvest time will not be sold until the following year, a small enterprise that handles 5,000 metric tons of hybrid seed might require credit for 9-10 months with a peak debt well over $1 million soon after harvest.

If the additional costs of biotechnology research are included, the cost of seed research and development increases dramatically. According to an EF Hutton study in the early 1980's, "the cost associated with starting a biotechnology company with ... the "critical mass" necessary to establish a viable firm is estimated to be about 25 Ph.D.'s and would require about $10-12 million of investment capital."[3]

Trends that developed in the late 1950's and are expected to continue well into the 1990's suggest that cooperatives must increase their efforts to keep some plant breeding under the ownership and control of farmers. Cooperatives must do this because:

1. State experiment stations generally have suffered from reduced funding. This has affected the maintenance of their plant breeding programs, slowing down the development of public domain varieties and accelerating the use of more proprietary varieties.

2. Public universities and experiment stations now often conduct research partially funded by private research grants. This often leads to exclusive distribution contracts with individual firms.

Conventional Plant Breeding

Conventional plant breeding consists of techniques and technological innovations developed during the early 20th century. Cross-pollination and hybridization have produced seed that offers improved standability, yield, and pest resistance. Many of the changes brought about by conventional plant breeding were revolutionary in the sense that they changed forever the way farmers would think about and purchase seed.

Conventional plant breeding is a slow, laborious process of selectively breeding a plant species to input desired characteristics in the resulting offspring. The ability to predict the results of the breeding process is limited. For example, a breeder may cross a high-yield, non-drought-resistant corn variety with a lower yield, drought-resistant variety, thus hoping to create a high-yield, drought-resistant variety. In order to obtain the desired result, the breeder must select out those genes that contain the desired trait from each of the parental varieties. This often proves difficult and time-consuming. This uncertainty in the breeding process

[2]Minimum distance in this report is described as the minimum genetic divergence necessary for two plants of the same species to be considered separate varieties.

[3]Genetic Engineering: Exploring the Impacts of Biotechnology on Industrial Structure, Martin Kenney et al., Bulletin No. 125, July 1982.

means that it can take 30 years or more to produce a marketable plant variety.

Biotechnology[4]

The seed industry is poised on the edge of the high-tech world of biotechnology and genetic engineering. Biotechnology and related techniques are expected to become a valuable set of tools for plant breeders. Employed by conventional plant breeders in their plant variety improvement programs, biotechnology will augment conventional breeding, producing evolutionary changes in the seed industry. Since the 1970's the industry has had the skill and technical knowledge to proceed, but it is being hampered on a number of fronts. This section focuses on a few of the difficulties facing biotechnology — in particular, public misperception and the lack of single Federal regulatory agency.

Public Perceptions The public's lack of knowledge about biotechnology inhibits the introduction of biotechnology into the production of consumer goods. Public concerns and misperceptions about the safety of genetically engineered products have led to delays in field trials and product introduction. A better informed public would be less apprehensive about goods produced through biotechnology. The education process should involve members from private enterprise, research institutions, universities, media, and government to ensure a broad base of opinions and to reduce the possible conflicts of interest — or even the appearance of such conflicts.

Regulation It was not until the mid-1970's that modern biotechnology became feasible, especially genetic engineering. Due to the newness of the industry, scientists requested help from Federal agencies to develop biosafety review mechanisms for research with recombinant DNA (rDNA) in contained laboratories. While this process resulted in a temproary delay in rDNA research, it provided science-based guidelines for assessing the impact and safety of contained rDNA research.

The field testing of genetically engineered organisms has produced the greatest concern over biosafety. Without field tests, it is very difficult to predict how a genetically engineered organism will interact with other organisms under varying environmental conditions. While many methods of assessment have been proposed, the approach to date has been a case-by-case review of each experiment under existing Federal regulatory statutes.

Currently, four separate Federal agencies are involved in the regulation and control of biotechnology: (1) the National Institutes of Health, (2) the USDA's Animal and Plant Health Inspection Service, (3) the Environmental Protection Agency, and (4) the Food and Drug Administration. Guidelines were established under the Federal Coordinated Framework for the Regulation of Biotechnology in 1986. However, these guidelines are broadly defined and each agency often interprets them differently, thus creating confusion in the scientific community. In February 1991, the President's Council on Competitiveness recommended revising the Coordinated Framework. The report suggested that agencies that oversee biotechnology should replace the original guidelines established in 1986 with Four Principles of Regulatory Review. Following is the set of Four Principles of Regulatory Review:

1. Federal government regulatory oversight should focus on the characteristics and risks of the biotechnology product— not the process by which it is created.

2. For biotechnology products that require review, regulatory review should be designed to minimize regulatory burden while assuring protection of public health and welfare.

3. Regulatory programs should be designed to accommodate the rapid advances in biotechnology. Performance-based standards are, therefore generally preferred over design standards.

[4]A complete discussion of all the issues of biotechnology would be too lengthy to be covered in a report of this nature. See, Lacy, William B., and Lawrence Busch, *Biotechnology and Agricultural Cooperatives*, Lexington, KY, AES, 1988; and Baumgardt, Bill R., and Marshall A. Martin, *Agricultural Biotechnology*, Purdue University, AES, 1991.

4. In order to create opportunities for the application of innovative new biotechnology products, all regulation in environmental and health areas— whether or not they address biotechnology— should use performance standards rather than specifying rigid controls or specific designs for compliance.

Many members of the seed research community feel that the Federal Government needs to designate one agency to regulate and control the biotechnology industry. It is felt that without a cohesive Federal policy managed by a single regulatory agency, the States will begin to regulate begin to regulate biotechnology individually. This could create a situation where certain biotechnological innovations would be allowed in some States while they would be banned in others.

Advances in Biotechnology Over the past 50 years, technological changes have resulted in one-third fewer farms producing 2.5 times more output, using only one-fourth as many workers. Regardless of the discoveries generated through biotechnology, it is doubtful that biotechnology can create the same type of changes in farm numbers and employment as prior technologies. Technologies of the past resulted in major shifts from labor-intensive to more capital-intensive practices. Future biotechnological developments are more likely to result in shifts from one capital-intensive resource to another.

The impact of biotechnology is expected to differ for the large-acreage field crops versus the small-acreage specialty crops. In the case of field crops such as corn, herbicide resistance and biopesticides are close to being marketed. Such innovations are expected to have little impact on the structure of farm production since most will not encourage acreage expansion. In the longer term, however, biotechnology may significantly increase the yields of a number of field crops.

For specialty markets, biotechnology already has the capability to modify the harvested product. For instance, clear hilum soybean varieties have been developed specifically to meet the demands of the tofu market. Biotechnology is expected to be particularly important for fruit and vegetable crops because it will enhance product quality, shelf life, and taste. Several tomato hybrids that resulted from biotechnological advances are already being tested. One such hybrid has a firmer meat that resists bruising in transit. This capacity will increase the extent to which processors can specify product characteristics. Advances in biotechnology will thus tighten the linkages among manufacturers of production inputs, farmers, and processors. Cooperatives are in a position to use collective bargaining to get the best contract for their member/owners.

Public Research

Land-grant universities have historically played a major role in the development of improved plant varieties. Today, there is increasing pressure to redefine the mission of the public research institution. Some of the seed industry experts we interviewed felt that varietal development should be left to the private sector and that public research institutions should concentrate on basic research, including maintenance, evaluation, and improvement of germ-plasm. The possibility of public research institutions dropping their applied research activities and focusing on basic research is of great concern to many in the seed industry, for different reasons. Large corporations employing numerous plant breeders could afford to train individuals to conduct plant breeding research. Smaller corporations and cooperatives, with local sales regions, can ill afford to hire untrained researchers for their plant breeding programs.

The high cost of research and development for emerging biotechnologies is beginning to strain the traditional State and Federal funding systems. As costs increase, public universities are turning to alternative sources of financing. Large corporations are providing vast amounts of capital to fund the research activities of these public institutions. Although some of the largest farmer cooperatives have become involved in the funding of public research, clearly most cooperatives have not.

The relationships developing between public and private concerns are causing some controversies with regard to publicly developed plant vari-

eties. Cooperatives, as well as small investor-owned seed companies, have historically relied on publicly funded research institutions for the majority of their research needs. But, the results of public research activities are becoming increasingly inaccessible to these groups. Increased private funding of public seed research institutions will reduce the access of smaller cooperatives and corporations to improved seed varieties.

Other problems occur when there are conflicts of interest between the university and/or its scientists and the private sector. These conflicts arise when those who fund the projects have access to the university facilities and can influence the type of research being performed. Under this situation, promising technologies may be circumvented because of the adverse impact they may have on the profits of a supporting corporation, which ultimately affects the institution's research budget.

Another conflict involves the intellectual property rights of research performed under joint ventures between public universities and private firms. Private sector firms could claim proprietary rights to all products and processes developed under these agreements even though they utilize both private and public funding. By deciding that research conducted by these joint ventures is proprietary, the free flow of information in the scientific community may be reduced. This could result in duplication of effort, adding further inefficiencies and increasing the cost to society.

The two experiment stations visited were actively using exclusive marketing agreements for new varietal releases. They felt that their exclusive agreements would not limit the use of the germ-plasm for research purposes but would provide the holder with varietal protection for a specified time. This protection includes the ability to collect royalties from sales of varieties developed from their protected germ-plasm. The research stations said all exclusive agreements include a "walk-in" clause. This clause states that a variety released for development to a seed company must be actively researched and developed and that the germ-plasm must be released to all legitimate research programs for development. If the germ-plasm is not being fully utilized by the seed company, the university has the authority to reclaim its rights to the variety for re-release.

Most larger regional cooperatives and other businesses did not object to exclusive marketing agreements. Most felt that universities must continue developing new varieties, if for no other reason than to train plant breeders. Almost all agreed that funding of public research institutes by private sources will continue to increase.

Cooperative Research Efforts

Cooperatives are currently involved in many phases of seed research. Several farm supply cooperatives employ plant breeders to develop proprietary branded seeds in their own research programs. A number of farm supply cooperatives joined together in 1961 to form FFR, a seed research cooperative located in West Lafayette, Indiana. Initially envisioned as a researcher of improved varieties of forage seed, FFR later expanded into cereal grains and row crops. Today, FFR is an inter-regional plant breeding research cooperative owned by five regional cooperatives. FFR has made significant progress in developing forage, soybean, and hybrid corn varieties.

In addition to farm supply cooperatives, there are also a number of producer or grower cooperatives involved in seed research. Cooperatives such as Cal/West (Woodland, CA) and NC+ Hybrids (Lincoln, NE) were started by independent seed growers to aid their research and marketing efforts. The seed produced by the cooperatives' members is sold under a cooperative label to take advantage of brand name recognition. It is marketed nationally and internationally by farmer/dealers or from retail outlets. The national and international successes of NC+ Hybrids and Cal/West indicate the ability of cooperatives to effectively operate outside the traditional local or regional market.

Although this report focuses on regional cooperative efforts in forage, soybean, and hybrid corn seed research, a number of cooperatives are conducting research and development on other seed types. The American Crystal Sugar Company (Moorhead, MN) is a major force in sugar beet research. Cooperatives are also involved in cotton,

rice, wheat, seed potatoes, and other vegetable seeds that have been developed either from public varieties or through in-house research programs.

Cooperative Investment in Biotechnology The development of new biotechnologies presents a dilemma to the farmer cooperative system. Few cooperatives have the capital resources necessary for a direct investment in basic biotechnology research. Unlike investor-owned firms (IOF's), cooperatives do not have actively traded public stock, so they lack access to venture capital through new stock issues. The cooperative system must rely on retained earnings, borrowed funds, or new capital investments by members to satisfy its capital requirements.

Some of the large regional cooperatives have decided that they must support their own biotechnology research programs. Cooperatives pursuing this route tend to have large research budgets and a strong customer base over which to spread development costs. Gold Kist Inc., conducts its biotechnology research and marketing program through AgraTech Seeds, Inc., an IOF subsidiary formed in 1982, in which Gold Kist owns a majority interest.

Other cooperatives are funding public research institutions and/or forming joint ventures with IOF's. Still other cooperatives have decided to take a more cautious approach to entering the field of biotechnology. These cooperatives seem to be content to watch the field, make contacts for the future, and wait for the inevitable shakeout. They are positioning themselves for an aggressive entry into the market as soon as substantial developments are realized. Since this strategy is very conservative, these cooperatives may not have enough time to form the necessary marketing agreements to capitalize on new products.

Seed Coating One area of seed research that has often been overlooked is the seed coating industry. It was once believed that seed coating, or micro-encapsulation, was going to revolutionize the seed industry. Today, there is not the same enthusiasm. Seed coatings are a pre-emergence package developed to provide a cost effective and environmentally sound method of applying agricultural chemicals. Seed coating involves the application of pop-up fertilizers, pesticides, and other chemicals via coatings or layers applied to the seed in the processing plant.

Several industry experts interviewed for this report suggested that the concept of micro-encapsulation was a good idea, but they were not impressed with the results to date. Early tests in this technology have shown that it is difficult to apply sufficient amounts of fertilizer or other chemicals to be effective for most seed varieties.

Despite a lack of enthusiasm for the technology, the environmental movement and public concern over food safety could benefit the seed-coating industry. Through a joint venture, Cenex/Land O' Lakes has remained involved, and is becoming an industry leader, in the technology of seed coating. Although they believe the advantages of seed coating are still being realized, they also believe the technology will not have wide application beyond vegetable seeds. Also, Canadian Seed Coaters recently opened up a fully automated seed-coating plant in Arizona as a joint venture with Valley Seed Company.

PRODUCTION

While almost everyone agrees that planting good-quality seed is important, definitions of good quality differ. The farmer or back-yard gardener may view good-quality seed as seed that looks nice. State seed certification agencies assess seed quality using more precise standards. Certification agents view good-quality seed in terms of analytical purity, moisture content, high germination percentage, freedom from airborne disease, and a high degree of genetic purity. Seed varieties are multiplied through a series of generations (Breeder Seed, Foundation Seed, Registered Seed, and Certified Seed)[5] until it is ready for sale commercially.

Breeder seed is multiplied by the plant breeder. Breeder seed is used for multiplication purposes only — for research and the development of subsequent generations of seed.

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[5]Terminology utilized by the AOSCA: (Association for Official Seed Certifying Agencies).

Foundation seed is multiplied under the plant breeder's care or by a special agency. Foundation seed is also used for multiplication purposes only.

Registered seed is multiplied by seed growers, seed farms, or seed enterprises for multiplication and sale or for further multiplication. It is the first generation of seed available for sale to farmers for commercial use.

Certified seed is the last step in seed production. At this stage, the seed is certified for its purity and trueness to variety. With the exception of producer-owned cooperatives, few cooperatives multiply seed beyond the breeder or foundation levels. Cooperatives, like IOF's, prefer to contract out the production of later generation seed stocks.

Production Contracts

Production contracts vary greatly in the number of stages or activities that are transferred between the grower and the seed company. These different stages include: making recommendations, furnishing inputs, providing labor, and providing a market for the seed. In some cases, so few stages are transferred that production under contract differs little from open production. In other cases, the seed firm provides so many services that the seed production operations approach that of a single vertically integrated firm. Production contracts may be classified into three categories based on the functional stages transferred between the grower and the seed firm: (1) market-specification contracts, (2) production-management contracts, and (3) resource-providing contracts.[6]

Market-Specification Contracts Market-specification contracts transfer the fewest stages between the seed firm and farmer/growers. In these contracts, the seed company assumes only a small amount of risk. Management functions provided by the seed firm are limited to decisions on what will be produced (i.e., seed variety) and when and where it will be marketed. The grower becomes more certain about the market for at least one production period and about the final price for seed produced. The grower continues to make production/operation decisions, provides and finances input purchases, and continues to assume production risk.

Production-Management Contracts Production-management contracts are similar to market-specification contracts but call for more direct management participation and risk assumption by the seed company. Management participation can take the form of resource specifications and field inspections during the growing season. This assistance may be especially needed when new growers or new technologies are involved. In the production of hybrid seed corn, for example, the seed company will specify seed crosses and may specify cultivation, fertilizer, pesticide and herbicide application, rouging, detasseling, and harvest and delivery dates.

Resource-Providing Contracts In resource-providing contracts, the seed company not only provides a market and participates in production management, but it also furnishes important inputs. Besides providing many of the services offered in the production management contracts, the seed company may provide labor, custom fertilizer and herbicide application, and may even harvest the seed. Due to the quality control required for varietal production, the seed industry uses production-management and resource-providing contracts almost exclusively.

Seed Production, Processing, and Handling

When sufficient quantities of seed have been produced, the seed must be cleaned, dried, sorted, bagged, and transported to distribution centers. Some of the larger contract producers own their own seed-processing facilities and perform many of these functions for the seed companies. However, most of the seed is transported directly

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[6]See, Mighell, Ronald L. and Lawrence A. Jones, *Vertical Coordination in Agriculture*, U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 19, February 1963.

to processing plants and these functions are performed by the seed companies themselves.

The 9 regional cooperatives interviewed for this study own and operate at least 37 facilities that clean, mix, condition, or otherwise process seed. These seed-processing facilities are used most often for corn and soybean seeds, but forage, wheat, and other seeds are also processed or mixed in these facilities.

Most agricultural farm supply cooperatives, which market their own seed varieties, use the same type of production contracts as IOF's. Few will produce beyond the breeder stock. Producer cooperatives, on the other hand, usually grow most of their seed stock and only contract out some production in order to meet demand. Several cooperatives contract with farmers to grow cotton, wheat, and rice seed.

MARKETING/DISTRIBUTION

Marketing seed in the United States is a highly complex activity involving product differentiation through advertising, pricing strategies, customer services, and differing sales methodologies, based on the type of seed and the geographical area in which it is being sold. Export marketing presents an even more complex picture as differing societal views and cultural norms are considered.

Domestic Market

This section discusses in more detail some of the marketing considerations within the domestic seed market. We begin with a description of the sales methods most often used to provide farmers with seed for farm production. These methods range from those that typically offer the fewest services (farmer/dealers and direct sales) to those that offer the most assistance from the seed seller (farm supply stores and cooperative farm supply outlets).

Sales Methods *Farmer/Dealers.* Farmer/dealers are most often used in the Midwest to sell hybrid seed corn. They typically live and farm in their sales territory and usually know their customers personally. Seed recommendations are often made from personal experience as well as from promotional information. Farmer/dealers typically have a relatively small sales territory and have exclusive rights to sell a particular brand within that territory. They often provide farmers with seed for roadside test plots to compare their company's seed with a competitor's.

Many individuals in the seed industry feel that farmer/dealers are becoming a less desirable method of selling seeds. The reliance on farmer/dealers inhibits the seed company's ability to offer an integrated system of services. In some areas, the farmer/dealer network has virtually degenerated into a system of direct sales. Nearly every large farmer has become a dealer for one brand of seed or another, and their only substantial sales are for their own operations.

Cooperatives generally do not use farmer/dealers. Cooperatives stress that offering a package of services in conjunction with seed sales is more important to the farmer. In areas where major seed companies use farmer/dealers, cooperatives would generally like to match the competition with farmer/dealers of their own, although they are not planning to do so in the near future.

Direct Sales. Many large corporate farms now want to bypass farmer/dealers and seed distributors and their normal markups, and buy directly from seed manufacturers. Because of these new demands, some manufacturers are offering direct sales through manufacturing representatives instead of using seed distributors and/or dealers. This method of distribution enables the manufacturers to respond quickly to large accounts and changing markets. The distribution process is streamlined by using independent salespeople to make the connection between the seed company and the farmer.

Direct sales usually offer no services after the sales. Larger farms that are demanding direct sales sometimes already employ personnel who are able to scout fields. These farmers bypass the need for special services in conjunction with seed sales. There are also a number of firms that specialize in field management and offer their services on a per-acre fee basis. A recent innovation in the area of

direct sales involves the formation of a purchasing or buying cooperative.

Buying Cooperatives. A buying cooperative operates as a bargaining agent for the benefit of a few members. In one instance, four farm management firms with control over several thousand acres decided to form a buying cooperative. The cooperative contacted all the seed companies their members had purchased from in the past and invited the companies to put together some information on selling large quantities of seed directly to the cooperative members. The members of the buying cooperative found that most companies contacted were willing to do business with them. Companies that refuse to sell direct to the buying cooperative were no longer considered. By buying from the seed company, the cooperative was able to cut member seed costs by 18-24 percent for corn and 12-20 percent for soybeans.

This type of cooperative is typically formed to provide beneficial seed purchasing agreements only. Although the cooperative would be able to provide whatever services its members desire, the additional cost could be quite high because of the small number of cooperative members.

Farm Supply Stores. Farm supply stores are sole proprietorships or investor-owned stores providing access to a large range of farm inputs. In many areas of the United States less than 25 percent of the available farmland is planted to corn, wheat, or soybeans. The diverse cropping patterns of farmers in these areas reflect the fact that the opportunities for large purchases through farmer/dealers or direct sales are not present. Depending on the size of the farm supply store, it might offer additional services and/or employ a seed specialist. This type of farm supply store would offer services very similar to a cooperative farm supply outlet.

Cooperative Farm Supply Outlets. More than 2,500 cooperative farm supply outlets in the United States sell seed for farm production. These outlets are often the largest employer in many rural communities. They are owned by their farmer- members and operate at cost. Farmers annually purchase about 15 percent of all their seed inputs from farm supply cooperatives. In addition to seed inputs, farm supply cooperatives typically provide access to a variety of services and products such as animal feeds, veterinarian supplies, fertilizers, pesticides, herbicides, custom applicator service, equipment rental, and expert opinion/scouting services.

Cooperative farm supply outlets sell either their own brand of seed, one company's brand, or several companies' brands. This outlet might advertise in local media (newspaper or radio) and have test plots that compare their brands with a competitor's brands. Often, a cooperative farm supply outlet will sponsor a field day, inviting farmers to a test plot where various brands of seed, fertilizers, and agricultural chemicals are compared. The field day promotes the cooperative's products and often encourages early sales by offering discounts if farmers place their orders at that time.

Geographic The marketing philosophy of many seed companies varies with the area of the country where the seed is sold. In most areas the seed is usually distributed centrally in farm supply stores. An individual farm supply store may stock several brands of seed, enabling the farmer to shop for the seed most suited to his or her needs. In other areas of the country, particularly in the Midwest, the dominant method of seed sales is through farmer/dealers. Typically the farmer/dealer will represent only one brand of seed and will call on the farmer to discuss his or her seed requirements.

When hybrid corn was first introduced, farmer/dealers became the dominant form of distribution channel for hybrid corn seed. Companies that employ farmer/dealers usually have more than 75 percent of their sales associated with hybrid corn. Whether through tradition or for some other reason, industry leaders continue to market their seed through the farmer/dealer network.

Table 3 illustrates the national percentage of major crops grown, by region. Over 80 percent of all corn, 75 percent of all soybeans, and just over 50 percent of all wheat is grown in the Midwest. The seed company is able to sell through a farmer/dealer or even directly to the farmer with

Table 3—Percent of major crops grown nationwide, by region in 1987

Region	Corn	Wheat	Cotton	Crop Soybeans	Forages	Vegetables
			Percent			
Northeast	3.0	0.6	0.0	0.6	6.8	7.3
Midwest	84.0	53.9	2.0	74.6	36.1	25.9
Southeast	5.0	2.7	4.8	6.9	4.3	16.8
South	6.0	18.8	77.5	17.9	14.1	9.0
Mountain	1.5	17.3	4.7	0.0	34.5	6.4
Pacific	0.5	6.7	11.0	0.0	4.2	34.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: *Survey–U.S. Census of Agriculture 1987*, U.S. Department of Commerce, Bureau of the Census.

minimal cost. If the seed company is willing to sell directly or indirectly to the farmer, there will be little incentive for farmers to purchase seed from their cooperative or other farm supply store.

In the Northeast, Southeast, and South, farmer/dealers are not as common as they are in the Midwest. Most seed sales are accomplished through cooperatives and farm supply stores. In these regions, most farmers purchase many different varieties of seed. Less than 25 percent of total farmland is allocated to corn, soybean, and wheat. With corn accounting for only 16 percent of all crops grown in these areas, farmers tend to frequent farm supply stores to acquire seed and not to rely on a farmer/dealer.

Service Seed prices increased an average of 5 percent per year between 1985 and 1990 (table 4) and farmers are demanding greater service for their money. Increased competition among seed companies means that services provided before and after the sale have become a key factor in gaining market share. Both IOF's and cooperatives indicated that services will play a major role in future seed sales.

Services provided prior to seed sales include making recommendations on the type of seed, chemicals, and fertilizers to be used to meet soil types and growing conditions. Services after the sale include scouting crops for pest damage and determining if crops have been damaged by herbicide use. Cooperatives appear to have an advantage over many IOF seed companies in offering to their customers both pre-sale and post-sale services based on their experience in chemical and fertilizer sales and their close affiliation with their member-patrons. The reliance of some IOF's on farmer/dealer networks inhibits their ability to offer an integrated system of services. The IOF's interviewed indicated they have held discussions with cooperatives in an effort to integrate their product with the cooperative's service system and form a joint sales program.

Several cooperatives indicated that they formerly provided these services to their member/owners free of charge. Today, most charge for these services because, increasingly, farmers were using the services but not purchasing their seed or chemicals from the cooperative. Many of these cooperatives will credit the amount of the fee back to the farmer who makes a seed and/or chemical purchase at the cooperative.

Most cooperatives interviewed indicated that their farm supply outlets have crop specialists or

agronomists who work with the farmer. Typically, these crop specialists are certified for chemical and fertilizer applications, but they may have only a limited understanding of the varieties of seeds available. Most cooperatives interviewed felt that there was a need for a seed specialist who could make specific seed recommendations, much as the crop specialist does in chemical sales. However, unlike chemical sales, the margins on seed sales (except hybrid corn) cannot always justify the expense of keeping a specialist on staff.

Several people interviewed for this report also mentioned potential problems associated with recommendations presented by crop specialists. Often, instead of recommending the best combination of seeds, fertilizers, and chemicals based on the farmer's situation, the analysis by a specialist is restricted to recommending only those products carried by the firm employing the specialist. Further restrictions may also limit the recommendation to only those products the firm has in stock in sufficient amounts to service the customer. Of course, a firm (or cooperative) employing a specialist making recommendations based on inventory levels rather than the best combination of products available to the farmer would soon lose that farmer as a customer. This sort of problem with recommendations by crop specialists can be alleviated when the cooperative offers a broad range of products and maintains sufficient inventory, either by itself or through an inventory-sharing arrangement with other cooperatives.

Product Differentiation Seed companies have had mixed success in promoting branded products. Products offering varietal protection through hybridization, such as seed corn, show a high degree of product differentiation and brand name recognition. In open-pollinated varieties, such as soybeans and wheat, product differentiation and brand name recognition are lower. Cooperatives and investor-owned seed companies try to enhance the product differentiation of both hybridized and open-pollinated varieties through advertising.

Advertisements or promotional displays must motivate the farmer to purchase a specific compa-

Table 4—Seed prices paid by farmers during 1985 and 1990

Crop	Year 1985	Year 1990	Change
	Dollars	*Dollars*	*Percent*
Peanuts	135.17	194.74	44.07
Sunflower	566.69	792.33	39.82
Alfalfa Certified	482.90	650.84	34.78
Cottonseed	106.28	139.69	31.43
Grain Sorghum	145.75	179.82	23.37
Soybeans	26.24	32.16	22.55
Barley	11.25	13.51	20.10
Wheat	13.45	15.56	15.71
Corn Hybrid	158.32	179.82	13.58

Prices are based on 100 kilograms of seed, and all prices are in 1985 dollars.
Source: *Agricultural Statistics 1990*, U.S. Department of Agriculture.

ny's seed. The farmer must be led to believe that a particular seed or variety offers advantages through higher yields, better germination rates, lowered costs, etc. A very effective way to accomplish this is to let farmers see actual results — through field trials or test plots — on land in their general area. Use of a roadside sign in combination with field trials can be particularly effective in getting a variety noticed.

Product differentiation can also be achieved through media advertising. Most advertising experts feel that the printed media is the most cost-efficient form of seed advertising, while radio advertising is the least effective. Almost all seed companies and cooperatives advertise in local magazines and newspapers and most use television. Television advertising is felt to exhibit the best overall recall. However, because of the expense, cooperatives and IOF seed companies tend to limit its use.

Cooperative seed experts feel that farmers are starting to become less brand-conscious and more deal-conscious. Younger farmers are looking for the best features, prices, and financing, and will often compare suppliers. Getting the word out on the advantages of using a new seed variety through advertising is of the utmost importance. Therefore, advertisements based on information and product support instead of brand names will be more effective.

Export Market

The domestic seed market is considered by many to be a mature industry. Short of dramatic new product developments coming out of biotechnology research, few opportunities exist for rapid growth in seed sales. Urban sprawl, governmental acreage reduction programs, and, above all, low agricultural prices have resulted in a declining base of land available for agricultural production. This decline has resulted in increased competition for the remaining domestic seed sales. In an effort to expand income potential, progressive seed companies are striving to protect their domestic sales while developing export markets.

Development of these export markets is not easy. It requires that cooperatives and IOF seed companies cultivate an understanding of local customs, beliefs, and agricultural practices. It requires suppliers to provide a product designed for the agricultural conditions and environmental pressures present in the export region. It also requires the creation of research and sales programs tailored to meet the demands of each potential export market.

A small number of cooperatives have developed extensive export markets. These export markets account for up to one-third of their total seed sales. Most cooperatives, however, focus exclusively on the domestic market. To date, cooperatives, as a whole, lag far behind investor-oriented firms in the development of export opportunities.

COOPERATIVE OPPORTUNITIES IN SEED

As a group, agricultural cooperatives have the most extensive distribution system in America for farm inputs. Today, seed and other inputs are sold in over 2,500 farm supply cooperatives nationwide. Despite this impressive distribution system, the cooperative share of seed sales has declined over the past decade, dropping from 17 percent to about 15 percent of the market. The ability of cooperatives to take advantage of their distribution system is being hampered by the fragmented nature of the cooperative seed industry.

Few cooperatives can individually afford to support in-house biotechnology research programs. Yet, this research is clearly emerging as a dominant force in the future of the seed industry. Numerous approaches were identified in interviews with cooperatives as actions they can take in response to advances in biotechnology.

First, they can do nothing. While this strategy involves no investment risk or cost, the cooperatives risk losing their share of the seed market as their product lags behind that of firms employing biotechnology.

On the other hand, cooperatives can respond to developments in biotechnology through a variety of methods. They can (1) form a biotechnology cooperative or firm, (2) support public research institutions, (3) form a full or limited joint venture with a biotechnology firm and/or, (4) maintain pre-

sent industry positions and develop marketing agreements with biotechnology firms when opportune.

The formation of a biotechnology cooperative (or jointly owned subsidiary of all cooperative members) is the most proactive method of acquiring biotechnology. Member cooperatives would be required to make a considerable up-front investment into this venture. The biotechnology cooperative would need to develop seed varieties for all growing zones of interest to their member/owner cooperatives. With this approach, investment is great and risks are high, but so are the potential returns.

Investment in, and support of, public agricultural research institutions is another way of accessing biotechnology. Land-grant universities, such as Iowa State University, Purdue University, and North Carolina State University, offer state-of-the-art biotechnology research programs as well as established plant breeding programs. This strategy also requires up-front investment, but with less risk. The cooperative may also be able to obtain exclusive rights to the research results through marketing agreements.

The use of joint ventures with an existing biotechnology company allows a cooperative to become associated with one or more firms having proven track records in specific areas of research. A full-scale joint venture typically would require a cooperative to make a relatively large commitment of up-front capital. In this type of joint venture, the cooperative has some control over the direction of research efforts, although it is impossible to predict whether future research will produce seed varieties with significant improvements over existing ones. The cooperative also risks tying itself too closely to one firm, limiting its ability to pursue other promising biotechnological ventures.

A limited joint venture would enable the cooperative to enter the market proactively, yet remain available to a wide range of research programs. The cooperative would provide a limited amount of up-front capital and gain access to research through open-end marketing agreements. The possible return may not be as great as that from a full joint venture, but neither is the risk associated with research and development. Use of limited joint ventures would enable the cooperative to act as a marketing agent for several competing biotechnological firms.

The final approach for agricultural cooperatives interested in biotechnological seed research is to position themselves as marketing specialists within the industry. This approach builds on cooperatives' present reputation as dominant input distributors. But the method is reactive because marketing specialists are forced to wait until a product is ready for release before attempting to gain access to it. Cooperatives following this course of action risk losing market share as access to the emerging biotechnological innovations are acquired by more aggressive competitors. To reduce the possibility of being shut out of certain product markets, cooperatives would need to adopt a strategy of cultivating relationships with potential products suppliers, and they would need to do this well before these products become available.

To combat the perception of cooperatives as the second/third supplier of farm seeds, the system needs to tighten up its fragmented approach and develop a single nationally/internationally recognized seed research cooperative. This seed research cooperative would develop seed varieties for its member cooperatives, who would then market the seed under a single cooperative brand. Development of an integrated national seed cooperative will require many regional cooperatives to forgo their separate seed research programs and concentrate on their wholesaling/marketing functions. It will require building on to the existing network of cooperative seed research and development associations.

The idea of farm supply cooperatives banding together to process or develop a particular farm input is not a new one. The National Cooperative Refinery Association in McPherson, KS, a cooperative petroleum refinery, and CF Industries, Inc., in Long Grove, IL, a cooperative fertilizer manufacturer, are examples where farm supply cooperatives joined interregional cooperatives. Regional cooperative members of these two interregional cooperatives already have in place working relationships with other cooperative members to facili-

tate creation of a single national seed interregional along the lines of this model.

Development of a strong cooperative brand in sales is also not a new idea. Cooperative brands are utilized in other areas, for example, Sunkist, C&H Sugar, Ocean Spray, Blue Diamond, Land O'Lakes, and American Crystal Sugar are all well known in the food industry. These brand names serve to illustrate the ability of cooperatives to establish a brand name and to market that brand, to noncooperative members, on a national and/or international basis. Within the seed industry, brands from investor-oriented firms (Pioneer, Dekalb, Northrup King, etc.) dominate the landscape. Cooperative brands are, in most cases, known only in local or regional niche markets.

While forming a national seed research cooperative may seem like a monumental task, the cornerstones for such a system have been cut and are ready to be laid. Increasing support of existing cooperative seed efforts, such as FFR, would be a good beginning. Hypothetically, consider the formation of a cooperative utilizing the following existing cooperatively owned firms: NC+ Hybrids, a seed growers cooperative in the Midwest/Great Plains area with limited national sales; Cal/West, a regional seed growers cooperative in California with limited national and international sales; FFR, a interregional seed research cooperative in the eastern corn belt with ties to much of the Eastern United States; Cenex/Land O'Lakes, two regional cooperatives with extensive research capabilities that have combined their agronomy operations in the Upper Midwest; and Gold Kist, a regional cooperative in the Southeast with research capabilities and ties to biotechnological research.

The cooperative efforts of these five regional and interregional cooperatives would bring together much of the best cooperative research in hybrid corn, soybeans, forages, cereal grains, and grasses as well as access to biotechnology. The established National and international markets of NC+ Hybrids and Cal/West, as well as the regional and interregional markets of the remaining cooperatives, would serve as a stepping stone to a better market position for the entire cooperative system.

While it remains a viable strategy, cooperatives do not need to spend millions of dollars on advanced biotechnological research to maintain a presence in the seed industry. They can successfully reassert themselves in the seed market through a collective redeployment of their present seed research, marketing, and sales assets. By working together, cooperatives can exploit their strengths and improve the return to their farmer-members' investment in the seed industry.

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Agricultural Cooperative Service (ACS) provides research, management, and educational assistance to cooperatives to strengthen the economic position of farmers and other rural residents. It works directly with cooperative leaders and Federal and State agencies to improve organization, leadership, and operation of cooperatives and to give guidance to further development.

The agency (1) helps farmers and other rural residents develop cooperatives to obtain supplies and services at lower cost and to get better prices for products they sell; (2) advises rural residents on developing existing resources through cooperative action to enhance rural living; (3) helps cooperatives improve services and operating efficiency; (4) informs members, directors, employees, and the public on how cooperatives work and benefit their members and their communities; and (5) encourages international cooperative programs.

ACS publishes research and educational materials and issues *Farmer Cooperatives* magazine. All programs and activities are conducted on a nondiscriminatory basis, without regard to race, creed, color, sex, age, marital status, handicap, or national origin.